ACPES Journal of Physical Education, Sport, and Health 5 (1) (2025)

ACPES Journal
of Physical Education, Sport, and Health

http://journal.unnes.ac.id/journals/ajpesh

The Impact of Effriction and Frirage Massage Techniques on Pain and Range of Motion Improvement in Knee Injuries

Cahulul Rizaldy Hasan, Arif Setiawan, Andry Akhiruyanto

Universitas Negeri Semarang, Indonesia

DOI: https://doi.org/10.15294/ajpesh.v5i1.23467

Keywords

Injury, Knee, Massage, Pain, ROM

Abstract

Introduction: Daily physical activities, especially sports, always contain the risk of injury, which most often occurs in the lower extremities, especially the knee joint. Knee injuries are generally caused by direct trauma, excessive pressure, or incorrect movement techniques, resulting in clinical symptoms such as pain, swelling, and decreased range of motion that can interfere with daily activities. Many athletes and the general public experience this problem, so proper and fast treatment is needed. **Purpose**: This study aims to evaluate the effectiveness of two massage methods, namely effriction and frirage in treating knee injuries with a 2x2 factorial experimental design. **Method**: The study sample was purposively selected and then divided into four groups based on the type of massage and duration of injury (10 days and 1 month). Two main parameters were measured: pain level using a Visual Analogue Scale (VAS) and joint range of motion using a Goniometer. Data were analysed using SPSS through normality, homogeneity, and Two-Way ANOVA tests to test for differences in treatment effects. **Results**: The results showed that effriction was more effective in reducing pain at 1 month (58.33%) compared to 10 days (44.44%), while frirage was optimal in the initial phase (34.92%). ROM improvement was more significant on long-term therapy (effriction: 21.64%; frirage: 18.24%). Two-way ANOVA analysis revealed a significant interaction between the massage method and the duration of injury ($p<0.05$). **Conclusion**: The selection of massage technique should consider the duration of injury, with effriction for long-term treatment and frirage for the acute phase for optimal rehabilitation outcomes.

INTRODUCTION

Humans perform physical activities every day, from light activities to strenuous activities. Exercise always carries the potential risk of injury (Febrian, 2017). Exercise is not only a form of recreation but also an important alternative to maintaining a healthy body. The development of technology in this modern era is accompanied by a decrease in physical activity in everyday life. Many people are starting to feel various negative impacts, such as muscle pain and other health problems, due to inactive daily habits (Søgaard & Sjøgaard, 2017).

Environmental stresses and human factors during exercise often lead to injuries that can affect a person's life (Travers et al., 2022). Any physical activity, especially sports, has the potential to cause injuries that impact physical activity levels, psychological state, and performance (Pasaribu et al., 2022). Sports injuries can force athletes to stop training and be traumatizing, especially if they interfere with daily activities (Mansur et al., 2018; Ilham, 2023). Sports injury is defined as damage to the structure and function of the body caused by physical or chemical stresses that occur during sports activities. Sports injuries refer to any form of activity that exceeds the body's threshold, occurring either during training, during competition or post-competition.

Sports injuries occur due to an imbalance between the workload and the capacity of the body tissues involved (Aldiansyah et al., 2021). The body parts that are often injured are bones, muscles, tendons and ligaments (Festiawan, 2021). Injuries are divided into acute injuries or sudden injuries, such as strains, sprains, and fractures, and chronic injuries or overuse syndrome, such as feeling pain. However, they can still be used for activities. Injuries to the lower extremities, especially the knee, are common because this part is more dominantly used in activities, which can result in limited range of motion and pain during activities (Syarifudin & Roepajadi, 2020). Knee injuries result in limited ROM or joint mobility, which translates into discomfort and pain during daily activities.

The knee is a part of the lower extremity that often suffers from sports injuries, which can be caused by trauma, excessive pressure, or direct impact (Rizaldy, 2024). Knee injury is a common musculoskeletal disorder in athletes and the general public, with symptoms such as pain, swelling, and decreased range of motion, which can interfere with quality of life (Laily et al., 2024). Prolonged discomfort and decreased range of motion often require comprehensive treatment to restore function and reduce pain (Rosenow & Munk, 2021). Attempts to cure the condition of pain and decreased range of motion may include pharmacologic and non-pharmacologic treatments. Pharmacological treatments involve the use of medications to relieve pain in the joints, (Aldiansyah et al., 2021)muscles or ligaments, while non-pharmacological treatments include various therapies.

Massage is one of the manipulative therapies that aim to reduce pain and increase joint motion (Luklukaningsih et al., 2023)question and answer, free checks (tension, pulse and temperature. Massage can reduce functional discomfort caused by movement in daily activities. For athletes and workers who perform heavy physical activities, massage can help them restore the body's ability to perform better (Kandupi & Wahyudi, 2021). In sports injury massage, there are effriction (effleurage and friction) and frirage masque techniques. Effriction masque is a massage technique performed by rubbing and pressing over the surface of the skin and underlying soft tissue. Typically, this technique is performed with deeper pressure and focuses on specific areas that are experiencing tension or tissue adhesions. Effriction massage aims to break down tissue and increase local blood circulation; in addition to helping reduce pain, this massage technique can also increase local blood flow and relieve muscle tension more effectively (Arif Setiawan et al., 2024). In comparison, the frirage massage method is a lighter and softer massage technique than effriction. Frirage is done by rubbing the skin using the palm or fingers with a broader and more continuous movement . This technique focuses more on the surface of the skin and superficial muscle tissue. On the other hand, the frirage technique has benefits that are more focused on injury management, especially to reduce the degree of injury experienced, such as muscle tension or mild strains (Gräf et al., 2022)as a secondary outcome, improvement of hand function. Material and methods: The systematic review includes randomized controlled trials reporting on physiotherapy or sports therapy interventions published prior to February 2021 in the electronic databases PubMed, CINAHL and Web of Science. Following the guidelines of preferred reporting items for systematic reviews and meta-analyses (PRISMA. Frirage massage is very effective in reducing the degree of injury experienced by providing a relaxing effect on tense muscles and reducing inflammation in the injured area (Ernasari et al., 2023).

Based on the problems that occur at the Seger Waras Massage Clinic, Semarang City, many

people experience complaints of knee injuries that result in pain and limited ROM. It is necessary to make efforts by doing massages on pain and ROM recovery using a visual analogue scale (VAS) to determine pain intensity and a goniometer to determine changes in knee ROM after pre- and post-pain. The urgency of this study is the high prevalence of knee injuries, both in athletes and individuals involved in physical activity, which has a significant impact on reducing quality of life, pain, and limitations in range of motion. Although various treatment methods have been used, there is still a need for more effective approaches to reducing pain and restoring knee function. Effriction and frirage masque methods as non-pharmacological therapies have the potential to provide solutions in the management of knee injuries.

The purpose of this study was to evaluate and compare the effect of effriction and friage massage methods on reducing pain and increasing range of motion (ROM) in knee injuries, as well as analyzing the interaction between the two massage techniques with the duration of the injury. It is hoped that this study will provide a more comprehensive insight into the effectiveness of each method in the context of healing knee injuries, which in turn can help in the development of more efficient strategies for the treatment of knee injuries based on scientific evidence.

The State of the Art of this study is related to the use of effriction masque and frirage masque techniques for the treatment of knee injuries, which have not been widely compared in the context of pain reduction and changes in a range of motion (ROM). Some previous studies have demonstrated the effectiveness of effriction masque in improving blood circulation and reducing muscle tension, as well as frirage masque in reducing pain and inflammation in minor muscle injuries (Chaves et al., 2020; Polastri et al., 2019). However, research explicitly comparing these two massage techniques in the context of knee injuries and their effect on recovery time, such as at 10 days and 1-month injury duration, is limited. Previous studies indicated that massage therapy can accelerate injury recovery and decrease pain but did not investigate a specific comparison between effriction and frirage techniques (Mak et al., 2024).

METHODS

The design used in this research is an experimental method with a 2x2 factorial design. This method is used to test the effect of one or more variables on other variables. This experimental research uses two groups that get different treatment formulas, namely the provision of the effriction masque method and the frirage masque method. Each treatment was carried out for 15 minutes. The research subjects were selected based on the initial screening of injury duration to determine the effriction and frirage treatment groups. Participants were randomly divided into two groups, namely effriction masque method and frirage masque method. The population in this study were patients who visited Seger Waras Massage Clinic in Semarang City. The sample in this study were patients who had knee injuries. Samples were taken using a purposive sampling method and filtered using inclusion and exclusion criteria. Inclusion criteria include: a) Male, b) Experiencing knee pain, c) Mild to moderate pain, d) Suffering from non-specific knee injuries, e) Mild swelling, f) Willing to be a sample, g) Suffering from decreased motion function and ROM limitations, h) Age 20-40 years, i) Duration of injury (10 days - 4 weeks) in the chronic/overuse category. Exclusion criteria include: a) Open wounds, b) Moderate to severe swelling, c) Strain or sprain (grade 2 and 3), d) Still in the acute phase (1-3 days), e) Fracture or fracture. The data analysis technique used in this study was SPSS. The testing steps included (1) normality test, (2) homogeneity of variance test, and (3) hypothesis testing. Furthermore, the analysis was continued using two-way ANOVA.

Pain levels were measured at the pretest and posttest using a Visual Analogue Scale (Scale 1-10) and goniometer, as listed in Table 1.

Table 1. Pain Indicators on VAS (Nursalam, 2015)

Pain Scale	Score
No Pain	0
The patient has not complained of pain or can still tolerate pain because it is below the excitatory threshold, without interfering with activities	1-3
The patient begins to complain and moan, with pressure on the painful area, and begins to interfere with daily activities	4-6
Feeling uncomfortable, agonizing and unable to control oneself	7-10

Furthermore, to determine the percentage increase in the effect of the effriction masque method and frirage masque on reducing pain and changing ROM in knee injuries, this study uses the percentage increase formula, namely:

Percentage increase = (mean different)/(mean pretest) × 100%

RESULTS AND DISCUSSION

Statistical data analysis on the research sample of forty samples consisting of males is presented in Table 2

Table 2. Statistical Descriptive Analysis

Group	N	Age	Test Item	Min	Max	Mean ± Std. Dev
A1B1 Pretest	10	25,2	Pain	4	7	5,4 ±1,02
			ROM	86	115	102,2 ± 8,58
A1B1 Posttest			Pain	1	4	3 ± 1,00
			ROM	115	133	121,5 ±4,41
A1B2 Pretest	10	25,8	Pain	4	8	6 ±1,26
			ROM	85	110	100, 7 ± 7,90
A1B2 Posttest			Pain	1	5	2,5 ±1,12
			ROM	110	133	122,5 ±6,34
A2B1 Pretest	10	24,9	Pain	3	8	6,3 ±1,55
			ROM	80	110	98,5 ±8,25
A2B1 Posttest			Pain	2	6	4,1 ±1,22
			ROM	100	126	112,9 ±7,85
A2B2 Pretest	10	25,5	Pain	6	9	7,8 ±0,98
			ROM	90	115	103,6 ±8,81
A2B2 Posttest			Pain	2	8	5,5 ±1,96
			ROM	115	132	122,5 ±5,26

Table 3. Frequency Distribution of Injury Causes

Factor	Frequency	Percentage (%)
Sports	24	60%
Occupation / Non Sport	16	40%
Total	40	100%

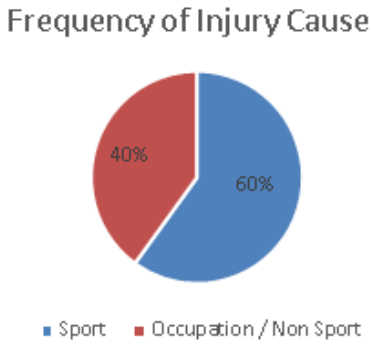

Figure 1. Frequency of Causes of Knee Injuries

The descriptive statistics table showed that 60% (24 samples) of the total reported sports activities caused injuries, while 40% (16 samples) were caused by work or non-sport activities. This distribution indicates that sports activities were the leading cause of injury in the observed sample, with a higher proportion compared to injuries related to work or daily activities.

Table 4. Percentage Improvement of Effriction Treatment

	10 Days			1 Month		
	Pretest	posttest	Percentage	Pretest	Posttest	Percentage
Pain	5,4	3	44,44%	6	2,5	58,33%
ROM	102,2	123,7	21,02%	100,7	122,5	21,64%

Based on the results of the study, the percentage of improvement in the effriction masase method for the 10-day group obtained data on pain improvement of 44.44% and ROM of 21.02%. While the percentage of improvement in the 1 Month group obtained pain data of 58.33% and ROM of 21.64%.

Table 5. Percentage improvement of Frirage Treatment

	10 Days			1 Month		
	Pretest	posttest	Percentage	Pretest	Posttest	Percentage
Pain	6,3	4,1	34,92%	7,8	5,5	29,48%
ROM	98,5	112,9	14,61%	103,6	122,5	18,24%

Based on the results of the study, the percentage of improvement in the Frirage massage method for the 10-day group obtained data on pain improvement of 34.92% and ROM of 14.61%. While the percentage of improvement in the 1 Month group obtained pain data of 29.48% and ROM of 18.24%.

Table 6. Pain Interaction

Tests of Between-Subjects Effects		
Variables	Mean Square	Sig.
Masage Method	42.025	.000
Duration of Injury	2.025	.334
Masage Method*Length of Injury	9.025	.046

The table above shows that the massage method has a significant effect on reducing pain in knee injuries ($p = 0.000$), while the duration of injury itself has no statistical effect ($p = 0.334$). However, there was a significant interaction between massage method and duration of injury ($p = 0.046$), which means that the effectiveness of massage method depends on the duration of injury.

Table 7. ROM interaction

Tests of Between-Subjects Effects		
Variables	Mean Square	Sig.
Masage Method	319.225	.009
Duration of Injury	198.025	.035
Masage Method*Length of Injury	319.225	.009

Based on the results of the *Tests of Between-Subjects Effects* analysis on the dependent variable Knee Injury ROM Change, it was found that the massage method had a significant effect on increasing *range of motion* ($p = 0.009$). Duration of injury also had a significant effect ($p = 0.035$), indicating that duration of injury (acute/chronic) can affect rehabilitation outcomes. There was a significant interaction between massage method and duration of injury ($p = 0.009$), confirming that the effectiveness of massage techniques depends on the duration of injury.

The discussion of this study's results provides further interpretation of the data analysis's presented results.

1. Effect of Effriction Masque Method on Pain Reduction and ROM Changes in Injuries

Data analysis in Table 4 shows a significant difference in the effectiveness of the intervention between the 10-day and 1-month periods. In the 10-day intervention group, there was a 44.44% reduction in pain, while in the 1-month group, the reduction reached 58.33%. These results indicate that the effriction intervention showed higher effectiveness in reducing pain intensity when applied over a more extended period. On the other hand, Range of Motion (ROM) improvement showed consistent results with an increase of 21.02% at 10 days and 21.64% at 1 month, with no significant difference between periods.

The effriction massage method significantly reduces pain by breaking down tissue adhesions and increasing local blood circulation, which in turn accelerates the healing process (Sadeghnia et al., 2023). Several previous studies have also proven that transverse friction techniques are effective in reducing pain in acute musculoskeletal cases (Khan et al., 2024). This technique works multifactorially through increased tissue perfusion, decreased muscle tone, and other mechanisms that play a role in reducing pain (Chaves et al., 2020). Based on this evidence, it can be concluded that effriction is an effective therapeutic modality to treat pain while restoring function in musculoskeletal injuries.

This study found that the effriction technique resulted in a steady increase in range of motion (ROM), with gains of 21.02% in 10 days and 21.64% in 1 month, proving its effectiveness in improving mobility in a relatively short period. This technique directly stimulates soft tissue and increases joint flexibility, which positively impacts ROM expansion (Hassan et al., 2016). These findings reinforce previous evidence that comprehensive massage therapy can increase cervical ROM, decrease trapezius muscle tone, reduce pain, and improve disability and quality of life in patients with neck injuries (Kang & Kim, 2022).

This study proved that friction therapy for one month achieved more significant pain reduction than the 10-day intervention. Both intervention periods resulted in equivalent ROM improvement. The findings recommend one-month therapy for targeted pain reduction and 10-day therapy for mobility improvement. The results of this study allow clinicians to develop a more targeted and efficient rehabilitation program based on the specific needs of the patient.

2. Effect of Frirage Massage Method on Pain Reduction and ROM Changes in Injuries

Based on Table 5, there is a significant difference in the effectiveness of the frirage method between the 10-day and 1-month periods. In the 10 days, the frirage method showed a decrease in pain of 34.92%, indicating that this technique is quite effective in reducing pain in the short term. The frirage massage technique is better used or applied to acute injuries such as acute pegging injuries Utomo (2019). After 1 month of injury, the pain reduction decreased slightly to 29.48%, suggesting that the effect of frirage in reducing pain may be more optimal in the early phase. Frirage technique can reduce pain (Naffza & Anggita, 2024).

The results showed that the increase in Range of Motion (ROM) reached a more significant value in the 1-month intervention (18.24%) compared to the 10 days (14.61%). This data is in line with the findings of Mustaqim et al., (2022), which explain that the frirage technique can increase soft tissue flexibility and progressively reduce muscle tone, resulting in optimal ROM improvement in

long-term therapy.

This study revealed that the effectiveness of frirage intervention varied based on the length of injury. In the early phase (10 days), the technique was more effective in reducing pain intensity, while at a longer time (1 month), it showed superiority in improving mobility through increased ROM. This phenomenon can be understood through Frirage's mechanism of action, which is: (1) it is fast in modulating acute pain through neurophysiological mechanisms, and (2) it takes longer to induce tissue structural changes that support ROM improvement.

3. Interaction Between Effriction Masque And Frirage Masque With Time Of Injury 10 Days And 1 Month On Pain Reduction In Injury

Based on statistical data analysis, it can be concluded that the independent variables have different effects on reducing pain in knee injuries. The massage method was shown to have a highly significant impact in reducing pain, with an F value of 42.025 and a significance level of 0.000 ($p<0.05$). This shows that the selection of appropriate massage techniques plays a crucial role in the management of knee pain. Massage therapy is effective in the management of knee pain (Akbar et al., 2025). The duration of injury did not show a statistically significant effect ($F=2.025$; $p=0.334$), indicating that the duration of injury factor is not directly related to the effectiveness of pain reduction. However, there was a significant interaction between massage method and length of injury ($F=9.025$; $p=0.046$), which revealed that the efficacy of massage therapy may vary depending on whether the injury is acute or chronic. These findings confirm the importance of a customized therapeutic approach based not only on the massage technique used but also on the duration of the patient's injury to achieve optimal results.

4. Interaction between Effriction Masque and Frirage Masque with Time of Injury 10 Days and 1 Month on ROM Changes in Knee Injuries

Based on the results obtained, several significant findings regarding factors that influence changes in Range of Motion (ROM) in knee injuries were revealed. First, the variable of the massage method showed a statistically significant effect on ROM improvement (Mean Square = 319.225; $p = 0.009$), indicating that massage intervention provides a meaningful therapeutic effect in improving knee joint mobility. Secondly, the duration of injury variable also has a significant impact (Mean Square = 198.025; $p = 0.035$), indicating that the duration of injury is an essential factor to consider in the rehabilitation process. This finding revealed a positive correlation between the length of injury and the degree of ROM change achieved.

The interaction between the Massage Method and Length of Injury also showed a significant effect, with a *Mean Square* value of 319.225 and a significance level of 0.009 ($p < 0.05$). This indicates that the length of injury may influence the effectiveness of the massage method in increasing ROM, or conversely, the length of injury may influence the response to a particular massage method.

Overall, these results suggest that massage method and length of injury are significant factors in improving ROM in knee injuries. In addition, the interaction between these two variables confirms that the combination of massage method and duration of injury has an essential influence on changes in ROM. These findings highlight that selecting an appropriate massage method is a crucial factor in rehabilitation, the duration of injury needs to be an essential consideration in devising therapy protocols, and a comprehensive therapeutic approach should consider the interaction between various factors that influence rehabilitation outcomes.

CONCLUSION

This study proved that effriction and frirage massaging methods significantly affected pain reduction and increased range of motion (ROM) in knee injuries, with different effectiveness based on the duration of the injury. Effriction massage was more optimal in reducing pain, especially in the 1-month intervention (58.33% reduction), while frirage was more effective in the early phase (10 days) with a 34.92% reduction in pain. Meanwhile, ROM improvement was more significant on long-term therapy for both techniques, with effriction showing consistency (21.02%-21.64%) and frirage reaching 18.24% after 1 month. The significant interaction between the massage method and length of injury ($p<0.05$) indicates that technique selection should be tailored to the characteristics of the injury (acute/chronic). These findings confirm the importance of a personalized rehabilitation approach, taking into account the combination of massage techniques and injury duration for optimal results while providing a scientific basis for the development of more effective therapy protocols.

ACKNOWLEDGEMENT

The researcher would like to thank the Institute for Research and Community Service of Semarang State University for its support in conducting this research.

REFERENCES

Akbar, A., Syahputra, D., & Ambardini, R. L. (2025). *The effectiveness of massage therapy on pain and range of motion (ROM) in knee injury patients at the health and sports center (HSC) clinic , yogyakarta state*. *10*(1), 10–13. https://doi.org/Annaafi Akbar Dany Syahputra and Rachmah Laksmi Ambardini DOI: https://doi.org/10.22271/yogic.2025.v10.i1a.1684

Aldiansyah, M. B. A., Ruddin, M., Studi, P., Jasmani, P., Nahdlatul, U., & Giri, U. S. (2021). Cedera Olahraga Takraw. *Seminar Nasional Sosial, Ekonomi, Pendidikan, Penelitian, Pengabdian Dan Kesehatan*, *1*(2), 161–169.

Arif Setiawan, Akhiruyanto, A., Haryono, S., Aziz, Z., Hidayah, T., Festiawan, R., & Awaludin, I. I. (2024). The effectiveness of effriction and frirage massage therapy in reducing pain in knee injuries: a comprehensive review of 1-month and 2-month injuries duration. *Retos*, *60*, 1164–1168. https://doi.org/10.47197/retos.v60.108816

Cahulul Rizaldy Hasan, K. A. (2024). Predicting Injury Risk in Sports Students: A Gender-Based Review. *Jurnal Pendidikan Jasmani Dan Olahraga*, *9*(1), 96–102. https://doi.org/https://doi.org/10.17509/jpjo.v9i1.67767 P

Chaves, P., Simões, D., Paço, M., Pinho, F., Duarte, J. A., & Ribeiro, F. (2020). Pressure applied during deep friction massage: Characterization and relationship with time of onset of analgesia. *Applied Sciences (Switzerland)*, *10*(8), 1–9. https://doi.org/10.3390/APP10082705

Chaves, P., Simões, D., Paço, M., Silva, S., Pinho, F., Duarte, J. A., & and Fernando Ribeiro. (n.d.). Deep Friction Massage in the Management of Patellar Tendinopathy in Athletes: Short-Term Clinical Outcomes. *Journal of Sport Rehabilitation*, *29*(7), 860–865. https://doi.org/https://doi.org/10.1123/jsr.2019-0046

Ernasari, E., Padhila, N. I., Kusumawati, P. D., Swamilaksita, P. D., Cahyani, D. D., Sriyanah, N., Maryani, L., & Amir, H. (2023). Effectiveness of FRIRAGE massage in the management of ankle injury in child. *Multidisciplinary Science Journal*, *6*(5). https://doi.org/https://10.31893/multiscience.2024059

Febrian, N. (2017). Pengaruh Aktivitas Fisik Yang Berlebihan Terhadap Perubahan Sistem Imun Seluler Spesifik. *Jurnal Teori Dan Aplikasi Aktivitas Fisik , 05, (1) 1-6*, *1–6*.

Festiawan, R. (2021). Terapi Dan Rehabilitasi Cedera Olahraga. *Universitas Jendral Soedirman*, *January*, 1–27. https://doi.org/10.31219/osf.io/gzcr3

Gräf, J. K., Lüdtke, K., & Wollesen, B. (2022). Physiotherapy and sports therapeutic interventions for treatment of carpal tunnel syndrome: A systematic review. *Schmerz*, *36*(4), 256–265. https://doi.org/10.1007/s00482-022-00637-x

Hassan, S. M., Hafez, A. R., Seif, H. E., & Kachanathu, S. J. (2016). The Effect of Deep Friction Massage versus Stretching of Wrist Extensor Muscles in the Treatment of Patients with Tennis Elbow. *Open Journal of Therapy and Rehabilitation*, *04*(01), 48–54. https://doi.org/10.4236/ojtr.2016.41004

Ilham, Z. (2023). *Penanganan pada cedera olahraga*.

Kandupi, A. D., & Wahyudi, A. (2021). Persepsi Tingkat Kepuasan Sport Massage Pada Masyarakat Desa Podi, Kecamatan Tojo, Kabupaten Tojo Una-Una. *Tadulako Journal Sport …*, *0383*, 30–40.

Kang, T., & Kim, B. (2022). *Cervical and scapula-focused resistance exercise program versus trapezius massage in patients with chronic neck pain*. *101*(39). https://doi.org/Received: 14 March 2022 / Received in final form: 23 August 2022 / Accepted: 24 August 2022 http://dx.doi.org/10.1097/MD.0000000000030887

Khan, S., Arsh, A., Khan, S., & Ali, S. (2024). Deep transverse friction massage in the management of adhesive capsulitis: A systematic review. *Pakistan Journal of Medical Sciences*, *40*(3), 526–533. https://doi.org/10.12669/pjms.40.3.7218

Laily, N., Astuti, W., Kep, M., Anatomi, A., & Sistem, F. (2024). *Sistem Muskuloskeletal*. 36–76.

Luklukaningsih, Z., Yunitasari, R., Uningowati, D. W., Setyaningtyas, A. F., Indrayanto, B., Susena,

D., & Sukini. (2023). Sosialisasi Dan Edukasi Fisioterapi Kepada Masyarakat Melalui Kegiatan Car Free Day Kabupaten Klaten. *WIDHARMA - Jurnal Pengabdian Widya Dharma*, *2*(02), 21–30. https://doi.org/10.54840/widharma.v2i02.165

Mak, S., Allen, J., Begashaw, M., Miake-Lye, I., Beroes-Severin, J., De Vries, G., Lawson, E., & Shekelle, P. G. (2024). Use of Massage Therapy for Pain, 2018-2023: A Systematic Review. *JAMA Network Open*, *7*(7), e2422259. https://doi.org/10.1001/jamanetworkopen.2024.22259

Mansur, L. K., Irianto, J. P., & Mansur, M. (2018). Pengaruh latihan squat menggunakan free weight dan gym machine terhadap kekuatan, power, dan hypertrophy otot. *Jurnal Keolahragaan*, *6*(2), 150–161. https://doi.org/10.21831/jk.v6i2.16516

Mustaqim, R., Ajid, O. N., Rimasa, D., Aulia, S., Hakim, N., Fahrizqi, E. B., & 1. (2022). *Angkle Injury Treatment Method Through Sport Massage Reviewing from Range of Motion (ROM)* (Vol. 1). Atlantis Press SARL. https://doi.org/10.2991/978-2-494069-79-4

Naffza, D. O. N., & Anggita, G. M. (2024). *Massage Teknik Stroking Effleurage terhadap Perubahan Tingkat Nyeri dan Range of Motion Pasien Cedera Ankle Akut*. *12*(2), 166–171.

Nursalam, N. (2015). Metodologi Penelitian Ilmu Keperawatan: Pendekatan Praktis. In Metodologi Penelitian Ilmu Keperawatan: Pendekatan Praktis (4th ed.). Jakarta. In *Metodologi Penelitian Ilmu Keperawatan: Pendekatan Praktis*.

Pasaribu, M., Irvan, & Amir, A. (2022). Pengetahuan Cedera Olahraga pada Siswa MTsN Barito Selatan Kalimantan Tengah. *Jurnal Pemikiran Dan Pengembangan Pembelajaran*, *4*(1), 145–152.

Polastri, M., Clini, E. M., Nava, S., & Ambrosino, N. (2019). Manual massage therapy for patients with COPD: A scoping review. *Medicina (Lithuania)*, *55*(5), 1–8. https://doi.org/10.3390/medicina55050151

Rosenow, M., & Munk, N. (2021). Massage for combat injuries in veteran with undisclosed ptsd: A retrospective case report. *International Journal of Therapeutic Massage and Bodywork: Research, Education, and Practice*, *14*(1), 4–11. https://doi.org/10.3822/ijtmb.v14i1.555

Sadeghnia, M., Shadmehr, A., Mir, S. M., Hadian Rasanani, M. R., Jalaei, S., & Salehi, S. (2023). Comparison of Immediate Effect of High-Power Pain Threshold Ultrasound and Deep Transverse Friction MassageonActiveMyofascialTriggerPoints. *Journal of Modern Rehabilitation*, *17*(3), 263–272. https://doi.org/10.18502/jmr.v17i3.13066

Søgaard, K., & Sjøgaard, G. (2017). Physical activity as cause and cure of muscular pain: Evidence of underlying mechanisms. *Exercise and Sport Sciences Reviews*, *45*(3), 136–145. https://doi.org/10.1249/JES.0000000000000112

Syarifudin, A., & Roepajadi, J. (2020). Pengaruh Mekanis Masase Lokal Ektremitas Bawah sebagai Pemulihan Pasif Terhadap Kekuatan Otot Tungkai Atlet Ju Jitsu. *Jurnal Kesehatan Olahraga*, *08*(1), 105–110.

Travers, G., Kippelen, P., Trangmar, S. J., & González-Alonso, J. (2022). Physiological Function during Exercise and Environmental Stress in Humans—An Integrative View of Body Systems and Homeostasis. *Cells*, *11*(3). https://doi.org/10.3390/cells11030383

Utomo, A. (2019). *Efektivitas massage frirage dan kombinasi back massage- stretching untuk penyembuhan nyeri pinggang*. *7*(1), 43–56. https://doi.org/https://doi.org/ 10.21831/jk.v7i1.20549 This